R E P O R T R E S U M E S

ED 011 065 24

PROGRAMED READING INSTRUCTION FOR CULTURALLY DEPRIVED SLOW LEARNERS.

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REPORT NUMBER BR-6-8438 PUB DATE AUG 66
CONTRACT OEC-2-7-068438-0069
EDRS PRICE MF-$0.09 HC-$1.80 45P.

DESCRIPTORS- PROGRAMED MATERIALS, DISADVANTAGED YOUTH, *SLOW LEARNERS, *BASIC READING, TEACHING MACHINES, WORKBOOKS, PRIMARY EDUCATION, *PROGRAMED INSTRUCTION, PROGRAMED TEXTS, *CULTURALLY DISADVANTAGED, *READING INSTRUCTION, BEGINNING READING, VOCABULARY DEVELOPMENT, TAMPA

THE EFFECTIVENESS OF PROGRAMED INSTRUCTIONAL MATERIALS FOR TEACHING BASIC READING SKILLS TO SLOW-LEARNING, CULTURALLY-DEPRIVED, 6 TO 9 YEAR-OLD CHILDREN WAS EVALUATED. THE MATERIALS STUDIED HAD BEEN EVALUATED PREVIOUSLY WITH EDUCABLE MENTALLY RETARDED SUBJECTS, 10 TO 16 YEARS OF AGE. THE STUDY WAS MADE TO DETERMINE WHAT MODIFICATIONS OF THESE MATERIALS WOULD BE NEEDED FOR USE WITH THE YOUNGER STUDENTS. THE 45 CHILDREN WERE DIVIDED INTO ONE CONTROL GROUP TAUGHT BY TRADITIONAL CLASSROOM TECHNIQUES AND TWO EXPERIMENTAL GROUPS, ONE TAUGHT BY MACHINE AND ONE TAUGHT USING PROGRAMED WORKBOOKS. EACH GROUP RECEIVED THE SAME LIST OF WORDS SELECTED BY THE AUTHORS. AT THE END OF THE EXPERIMENT, THE CHILDREN WERE TESTED FOR VOCABULARY IMPROVEMENT. THE SCORES OF EACH GROUP WERE STATISTICALLY COMPARED WITH EVERY OTHER GROUP. THE RESULTS SHOWED A STATISTICALLY SIGNIFICANT IMPROVEMENT IN VOCABULARY GAIN FOR THE MACHINE-TAUGHT GROUP OVER THE CONTROL GROUP AND FOR THE WORKBOOK-TAUGHT GROUP OVER THE CONTROL GROUP, BUT NO SIGNIFICANT DIFFERENCE WAS FOUND BETWEEN THE MACHINE-TAUGHT AND THE WORKBOOK-TAUGHT GROUPS. THE AUTHORS CONCLUDED THAT PROGRAMED INSTRUCTIONAL MATERIALS TEND TO INCREASE READING SKILLS AND ARE FEASIBLE FOR USE WITH THE POPULATION SAMPLED. (LB)

ED011065

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FINAL REPORT
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HEALTH, EDUCATION, AND WELFARE

Office of Education
Bureau of Research

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August 1966

The research reported herein was performed pursuant to a contract with the Office of Education, U. S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

THE MacDONALD TRAINING CENTER FOUNDATION, INC.

Tampa, Florida

INTRODUCTION

The purpose of this project was to conduct a pilot study to determine the effectiveness of programmed instructional materials with slow learning children taken from population settings with lower than average cultural preschool training and restricted home environment.

The programmed materials utilized were developed originally under two research grants from the United States Office of Education (CRP 1267 and OE 7-19-0315-291). The first of these two studies entitled, "The Comparison of Two Automated Teaching Procedures for Retarded Children," was directed toward the evaluation of two instructional techniques of presentation of programmed materials for the teaching of word recognition and reading. In this study some 3,000 frames were developed for the programmed presentation of 72 words commonly utilized in early reading instruction. The general purpose of the study was to evaluate the effectiveness of programmed instruction for use with mentally retarded children. A second objective was to compare the effectiveness of two automated teaching procedures with classroom instruction. The two presentation techniques utilized included a multiple choice method patterned after the work of Skinner and Holland (1960), and a typewriter keyboard instructional technique similar to that developed by O. K. Moore (1960) and by Benjamin Wyckoff (1960). The study is reported in full in the American Journal of Mental Deficiency (69, No. 3, 1963, pp. 405-412). Results showed pre to post-instruction word gains, pre to 30 day post-test retention, and pre to 60 day post-test retention. Both methods of programmed instruction produced significantly better results than normal classroom procedures.

A second project funded by the United States Office of Education (OE 7-19-0315-291), "Further Development, Comparison, and Evaluation of Programmed Instruction for Retarded Children," was initiated in 1964 for the purpose of determining the effectiveness of programmed text presentation for teaching word recognition and reading to mentally retarded children, to compare the effectiveness of programmed text and machine techniques, and to attempt to teach a broader range of words and word usage skills to a level of minimal literacy. This project, still in progress, has produced preliminary results which suggest the continued effectiveness of programmed instructional techniques as a method of teaching reading to the mentally retarded.

As a result of these positive findings, the investigators requested the opportunity to apply similar techniques and programmed instructional sequences already developed to the somewhat different population of public school slow learners, especially those from low socio-economic circumstances where some degree of cultural deprivation might be assumed. Because of the large overlap in characteristics of the slow learning population and the educable mentally retarded, the proposed study appeared to be a logical and appropriate extension of the earlier research.

It has been estimated by Deutch (1964), that from 40 to 70 per cent of the total school population of the 20 largest cities of the United States is made up of children from marginal social and economic circumstances. According to Kirk (1940), over 15 per cent of school children fall into the dull normal or backward categorization. Recent estimates reported by others and reported by Kirk (1962), suggest that over 30 per cent of school age children from low socio-economic circumstances may be classified as slow learners. By the time these children reach junior high school, approximately 60 per cent are retarded in their reading by

from one to four years. Results of a study by Kennedy (1959), show the average intelligence quotient of the Southern Negro at between 80 and 85. Most Southern Negroes come from impoverished social, economic, and intellectual backgrounds. It is evident, therefore, that large percentages of slow learners come from populations in which there is evidence of social and economic deprivation.

Both the educable mentally retarded and the slow learner frequently show evidence of motivational problems related not only to reading but to the total school environment. A "failure" syndrome often exists which involves lack of interest, lack of attention, and regression of social behavior. This, in turn, tends to increase the probability of early school dropout or later assignment to special classes.

Classroom teachers in previous studies have frequently reported dramatic attitudinal changes by students who have been involved in the experiences of programmed instruction. The problems of a burgeoning population and the slow growth of school facilities do not ordinarily permit a teacher the opportunity to provide as much individual attention to a student as might be feasible by programmed machine presentation or by programmed textual presentation. Earlier studies by the principal investigators, (Malpass, Gilmore and Williams, 1964) suggest that there are intrinsic advantages inherent in a relationship between the pupil and a teaching machine. The machine has the advantage of stimulating interest and attention and contributes to improved self-image because of the high rate of immediate positive reinforcement. In addition, the discrimination task necessitated by the choice of correct response appears to enhance perceptual skills.

It was hoped that intervention with specialized instructional techniques

might be useful in breaking the cumulative and self-perpetuating cycle of this "failure" syndrome. In the individualized, non-threatening relationship provided by programmed instruction the child is immediately rewarded by taking small steps with an inherent high probability of success. Immediacy of feedback in the form of praise or reward for successfully taking these small steps is a motivational factor in itself and the feedback occurs rapidly enough to influence the behavior from which the response stems (Skinner, 1961).

As utilized in this study, the slow learning child is defined as one possessing a borderline intelligence quotient, ranging between 75 and 90. He is not considered mentally retarded because he is capable of achieving a moderate degree of academic success, even though he may proceed at a slower rate than the average child. He is ordinarily educated in regular classrooms without special provisions or with minimal adjustments to fit his slower learning ability. At adult level he is usually self-supporting, independent and socially adjusted (Kirk, 1962).

Children falling in this category present a considerable problem to our school system for their academic retardation is usually insufficient to warrant assignment to special classes, even though they are not sufficiently bright to maintain the standards ordinarily required for average and superior children. If such children can be helped by specialized techniques such as programmed instruction, an enormous contribution to the school's instructional capability will have been made.

The terms "gain" or "word acquisition" as utilized in this study are defined as the differential results of pre-instructional and post-instructional testing in word recognition of all 93 programmed words. Retention refers to the differential or net number of words retained at 30 day post-

testing. Retention is also expressed as a percentage comparison with the immediate post-testing.

Increases in reading ability are reflected by scores on the Paragraph Reading phase of the Gates Primary Reading Test as measured in pre and post-instructional testing. More specific to the words actually taught, acquisition of reading skills is measured in part by performance on paragraph reading tests constructed of the words actually programmed and administered as pre and post-testing measures.

While other factors are pertinent, the learning ability of the elementary school child is largely dependent upon his degree of maturation as reflected by his mental age. Since 10 to 25 per cent deviation from the average mental age is subsumed by the previous definition of slow learner, it is reasonable to assume that the slow learner would not progress in academic skills as rapidly as the normal child. Since the ability to read is basic to almost all academic instruction, it is doubly important that the skills contributory to normal reading performance be acquired as early as possible.

Both phonic and word recognition methods are effective in teaching reading, according to Anderson and Dearborn (1952); however, the phonic methods tend to present difficulty, especially for retarded children, because of the vagaries of the English language itself. The word method has been cited as the quickest way to teach basic sight vocabulary (op. cit. p. 256). This method presents words as units and the child learns to recognize combinations of letters as representing objects and events. Many authorities suggest that word recognition is the most efficient way of promoting the vital function of retention (Monroe, 1932; Thorndike, 1934; Cruickshank and Johnson, 1958).

In addition to gains in sight recognition, retention is also an appropriate criterion for it is characteristic of retarded children to lose word recognition skills over a period of time (Kirk, 1940). Studies by Vernon (1958) and others suggest that conventional procedures have not been particularly effective in teaching slow learning children to read.

STATEMENT OF THE PROBLEM

The basic purpose of this pilot study was to evaluate the effects of differential programmed instruction on the acquisition and retention of word recognition, phrase recognition, sentence reading and concomitant reading skills of slow learning children.

More specifically, our objective was to compare with standard classroom instruction the efficiency of automated instruction utilizing programmed sequences prepared for the Mast Teaching Machine and the same set of programmed instructional frames presented by a conventional linear programmed workbook method. Both programmed instructional techniques are also compared with each other.

Research by Lumsdaine (1960), Stolurow (1961), Becker (1963), and others suggests that both machine presentation and programmed text presentation techniques are effective with normal students. Studies by Smith (1959), Blackman (1965), and Malpass, Gilmore and Williams' (1963), have shown the usefulness of automated instruction for teaching the educable retarded. Examination of the literature reveals no extensive studies evaluating the effectiveness of linear programmed instruction via machine presentation, or linear programmed instruction via textbook presentation for the marginal slow learning group. Neither have there been differential studies of the effectiveness of these two techniques with slow learning children.

Our problem then is to evaluate the usefulness of programmed materials designed for and shown useful with retarded children in the 10 to 15 year age range for instruction of younger but higher MA students from restricted environments. A secondary problem is to determine the feasibility and effectiveness of the two modes of presentation, machine and programmed textbooks.

SUBJECTS

While the project proposal called for only 36 subjects - 12 in each of two experimental groups and 12 in the control group-the final study is based upon data compiled on 45 subjects - 15 to each group.

Nearly two hundred possible subjects were examined in terms of the matching criteria: age, sex, intelligence, reading achievement, and socio-economic background. Forty-eight of these subjects were selected as constituting a homogeneous grouping. Subjects were drawn randomly from this larger group to constitute the three groups of sixteen each. Fortuitously, if any loss of subjects can be considered fortuitous, one subject from each group had to be dropped because of illness, being withdrawn from the school or moving away from the community thus leaving three balanced groups of 15 each.

Table I shows the matching variables for each group in terms of the selection criteria of age, sex, mental age and reading achievement. An additional variable, the number of programmed words known, is also included. Mental ages are given in this table as calculated from test performance on the Peabody Picture Vocabulary Test (Dunn, 1959).

TABLE I

SUMMARY OF DESCRIPTIVE VARIABLES FOR

SUBJECTS ASSIGNED TO THE THREE TREATMENT CONDITIONS

	Machine Group	Workbook Group	Control Group
Males	6	10	9
Females	9	5	6
Chronological Age			
Mean	7.8	7.3	7.3
Range	(6.8 - 10.2)	(6.8 - 8.8)	(7.8 - 8.6)
Mental Age*			
Mean	6.7	6.4	6.0
Range	(4.9 - 8.1)	(4.7 - 8.1)	(5.3 - 7.0)
Programmed Words Known			
Mean	18.3	17.3	18.6
Range	(7 - 34)	(0 - 32)	(0 - 36)
Gates Primary Reading Test - Paragraph Reading For Grade Placement			
Mean	1.47	1.56	1.56
Range	(1.3 - 1.9)	(1.3 - 1.9)	(1.3 - 2.2)

*Mental ages were calculated from scores on the Peabody Picture Vocabulary Test (Dunn, 1959).

The disparity in the number of male and female subjects of each group was a product of random assignment and the previously mentioned attrition.

Mean chronological ages were relatively close with a mean of 7.8 for the machine group, 7.3 for the workbook group and 7.3 for the control group.

Mental ages were also close with 6.7 for the machine group, 6.4 for the workbook group and 6.0 for the control group.

Reading level was measured by the Gates Primary Reading Test with a mean of 1.40 for the machine group, 1.56 for the workbook group and 1.56 for the control group.

The factor, programmed words known, revealed 18.3 words known by the machine group, 17.3 known by the workbook group and 18.6 known by the control group. In previous projects utilizing machine and workbook presentation of programmed instruction (Malpass, Gilmore and Williams, 1965, 1967) the number of programmed words known initially by the experimental subjects was found to be the best predictive variable of performance, thus the relatively close match in this factor takes on increased importance.

Ranges of the variables, as noted in Table I, were also relatively consistent.

Simple analysis of variance run on the factors of mental age and programmed words known on pre-testing showed no significant differences between groups. (See Table B, Appendix.) Complete sex, age, mental age, programmed words known and Gates Grade Placement scores are given for individual subjects in Table A of the Appendix.

Control for the factor, socio-economic background, was based upon the

district boundaries for the schools from which all subjects were drawn. These schools, V. M. Ybor School located in the Ybor City section of Tampa, Florida, Tampa Bay Boulevard School and B. C. Graham School, represent the lowest socio-economic grouping within the city of Tampa and are composed in large part of children of lower socio-economic class minority groups, including a high percentage of Negro, Spanish and Italian decent.

All subjects were drawn from the second grade within the mentioned schools except that one subject in each group was drawn from the third grade and one subject in both control and workbook groups was drawn from the first grade. All subjects were academically retarded by at least six months in terms of expected grade placement. Many subjects were repeating grades or had been given social promotions. All subjects were designated by their respective teachers as academically retarded, especially in reading skills.

All three groups, thus, were closely matched in terms of sex, age, mental age, reading achievement and number of programmed words known prior to instruction. No significant differences existed between the groups in terms of the most important matching criteria of mental age and number of programmed words known.

PROCEDURES

Subjects were grouped, as described in the section on subjects, according to the instructional method to be utilized. The subjects to receive instruction via the teaching machine method were designated as Group M, the subjects to receive instruction via the workbook method were designated as Group W, and the subjects chosen as controls were designated Group C.

Instructional Methods

The teaching machine group received instruction presented mechanically by means of the Mast Teaching Machine*, a mechanical optical device which provides rear projection of pre-prepared filmstrips on a ground glass screen. In operation a student examines the exposed top three-quarters of a frame presenting an individual item in linear sequence and then notes his selection of response on a mechanically actuated strip of adding machine tape located directly beneath the screen. He then presses the button marked "Answer" which actuates a mechanical slide revealing the correct response and which at the same time moves the adding machine tape forward approximately one inch to a position beneath a lucite shield so that the subject cannot alter his response but may still view it in relationship to the correct response then exposed on the screen. The subject having examined his response then presses the button marked "Advance" and the upper portion of a new frame in the sequence is exposed.

Loading, set up and focus of the machine are done by the technical assistant in attendance. The mechanical operation of the machine is relatively simple and was learned rapidly by all subjects.

The workbook group received instruction by means of linearly programmed printed material prepared by a lithographic plate process from the original art work and printed materials used in making the filmstrip presentations for the Mast Machines. A workbook consisted of approximately 19 pages, each page consisting of 4 sequential frames of

*These machines are sold by the Mast Development Company, 2212 East 12th Street, Davenport, Iowa 52803.

programmed material arranged vertically. The subject, utilizing a 4 x 6 file card as a screen, first exposed the top frame on the page which included both materials presentation and typically a three part multiple choice answer. Using a pencil the subject indicated his choice by circling it or marking it through with an X, he then exposed the answer portion of the frame by sliding his card approximately one-half inch further down the page and thus had an opportunity to compare his answer choice with the exposed correct answer. This provided the same contingency of immediacy of feedback as was provided in the machine presentation.

The sequence of frame presentations, the art work and all other factors were precisely the same as those utilized on the machine method, the only difference being the variable of workbook presentation as opposed to the machine presentation.

Subjects noted as "Control" were not exposed to the programmed instructional materials. Classroom teachers in each class containing control subjects were given a list of the words to be taught via machine and workbook presentation and attempted to integrate as many of these words as feasible into their daily classroom routine. In all such classes the teaching of reading and spelling was a standard part of the curriculum. The classroom routine thus was altered only by the introduction of a small percentage of words which might not routinely have been taught. It should be noted, however, that there is considerable overlap between the words which would ordinarily be taught in classroom sequence and the words being presented in programmed instruction.

The investigators recognize the problems inherent in the utilization of this type of control. There are those subjects who receive both programmed and classroom instruction on the programmed words. This

saturation remained by virtue of the circumstances involved an uncontrolable variable. As was anticipated, some progress was shown by the control subjects over the experimental period. The major variable, however, remains the fact that teachers must by virtue of our instructional system deal with large groups at a time while programmed instruction provides an almost tutorial type of interaction. Differences shown, thus, may reasonably be assigned to this factor.

Learning Conditions

All schools utilized for both experimental and control groups were located in neighborhoods representing the lowest socio-economic groupings with the city of Tampa. Specifically the schools were V. M. Ybor School located in the Ybor City Section of Tampa, Florida; Tampa Bay Boulevard School located in the West Tampa Section; and the B. C. Graham School located in Central Tampa. A high percentage of children in these schools come from home conditions which may accurately be described as culturally deprived. A large percentage of such homes were bilingual. Children of Negro, Spanish and Italian homes were in the majority

In each school a separate room was designated for purposes of programmed instruction. In some cases these rooms were the school clinic, the counselor's office or a spare classroom.

A regular schedule of instructional periods was maintained to which both students and teachers became accustomed over the experimental period. Students were sent to the special teaching room by their classroom teacher at a designated time, remained with the project research assistant during the period of programmed instruction and were returned to their classroom immediately following.

After the period of indoctrination during which teaching machine and workbook operational instructions were given and illustrated for each student, the research assistant in each school would routinely meet the child at the assigned time, provide him with the instructional material in the proper sequence and see that he began work on either the teaching machine or the programmed workbook.

The words presented in each programmed unit were reviewed orally with the subjects by the research assistant prior to each lesson. This procedure was considered to be essential, especially in the case of ambiguous words. In general the research assistant would offer little further assistance during the instructional period unless called upon by the student. Such instruction was kept minimal as opposed to providing individualized tutorial instruction. Each assistant would be supervising two or three subjects at any particular time. While some subjects required considerably more attention than others the research assistants were carefully instructed not to permit the student-instructor relationship to degenerate into a dependency or tutorial type of interaction.

Individual sessions for both machine and workbook techniques ran approximately the same at an average of 40 minutes per session per student. Some students finished in as short a time as 20 minutes while in some cases an hour was necessary for completion of the assigned program.

Evaluation

Evaluation of individual student progress was done by pre-instructional testing, immediate post-instructional testing and 30 day post-testing. Pre-testing was done with the Peabody Picture Vocabulary Test, a sight

recognition test of the programmed words, the Gates Paragraph Reading Test and a paragraph reading test constructed primarily of the programmed words. Immediate post-testing was done with the same instruments with the exception of the Peabody Picture Vocabulary Test which was utilized primarily in group selection and matching. Thirty day post-testing was done only on sight recognition of the programmed words and with the Gates Paragraph Reading Test.

Word gain scores from the test of sight recognition of programmed words are reported both in raw scores and percentages representing the number of new words gained. The gain or increment thus is the number of words recognized beyond the base line of recognition as assessed in pre-testing.

Peabody Picture Vocabulary Test scores are covered in the section on subject selection and summarized in Table I.

Results of the Gates Primary Reading Test are reported as raw scores and as grade equivalency. It should be noted, however, that in many cases pre-testing revealed raw scores below the minimum to which any conversion to an assigned grade placement is allowable on the Gates Paragraph Reading Test. In such cases, according to the instructions given with the Gates Test a minimum reading score of 1.3 is assigned, which may not necessarily reflect reading skills which have progressed that far. Thus, the comparison of pre to post-testing in terms of grade equivalencies is not totally meaningful. Raw scores give a better indication of actual progress made.

The reading paragraph test results (See Appendix Table C) are reported in terms of raw scores which represent the actual number of words recognized in context. No attempt at validation or an assignment of

grade equivalency scores for this test was made.

RESULTS

The period of contact with experimental subjects extended over a period of four weeks for an average total contact time of 13 hours per student.

The experimental group exposed to the programmed materials presented by machine gained 30.7 new words during the instructional period. The workbook group gained 33.1 words and the control group gained 4.5 words. In terms of percentages, expressing the relationship of words gained to words known the machine group gained 166 per cent, the workbook group gained 191 per cent and the control group gained 24 per cent.

On the Gates Primary Paragraph Reading Test the machine group gained an average of 2.9 raw score points over the instructional period, the workbook group gained an average of 2.1 and the control group gained an average of 1.4. Expressed in terms of grade level advance utilizing raw score converted to grade level scores and subject to the restrictions mentioned previously in this report the pre to post-test gain for the machine group was .19 grade, for the workbook group was .16 grade and for the control group was .08 grade.

The paragraph reading tests show mean "in context" word recognition gains of 75.2 for the machine group, 61.7 for the workbook group and 25.5 for the control group. Ranges for the above reported scores are given in Table 2.

Calculation of "t" ratios between each group on word gains showed significant differences between both the machine and control, and the workbook and control groups. No significant difference was found between the

TABLE 2

GAINS FOLLOWING INSTRUCTION

	Machine	Workbook	Control
Programmed Words (N-93)			
Pre to Post Test	30.7	33.1	4.5
Range	8 to 50	10 to 15	-1 to 10
Pre to 30 Day Post	30.9	30.1	10.9
Range	11 to 58	11 to 50	1 to 34
Gates Paragraph Reading Test Raw Score			
Pre to Post Test	3.2	2.1	1.4
Range	-3 to 7	-1 to 7	-4 to 7
Gates Paragraph Reading Test Grade Placement			
Pre to Post Test	.19	.16	.08
Range	-.30 to .55	-.05 to .50	-1.50 to .65
Paragraph Reading Test (Of Programmed Words)			
Pre to Post Test	75.2	61.7	25.5
Range	24 to 144	20 to 145	3 to 64

machine group and the workbook group. (See Appendix Table H)

Delayed post-testing was done approximately 30 days after immediate post-testing. At the end of 30 days the machine group showed word gains of approximately the same as the immediate post-testing with a score of 30.9; the workbook group showed a small decrease on the 30 day post-test with a score of 30.1; the control group showed an increase on 30 day post-testing with a score of 10.9. As with the programmed word gains pre to post-testing the "t" tests showed no significance between machine and workbook groups and did show a significant difference between experimental and control groups. (See Appendix Table H)

Expressed in terms of percentage retention the mean scores for the post-test to the 30 day post-test period were 100.6 per cent for the machine group, 90.8 per cent for the workbook group and 242.0 per cent for the control group.

Post-testing at the 30 day interval was not done with the Gates Paragraph Reading Test because of the aforementioned lack of sensitivity of this instrument. Time and personnel limitations also precluded the administration of the Paragraph Reading Test at the 30 day interval.

DISCUSSION

In a pilot project such as this the assignment of a cause and effect relationship to the control variables is especially difficult. It is notable, however, that the gains made by those students assigned to the teaching machines and those assigned to programmed instruction presented by means of workbooks were significantly greater than the gains made by the designated group of control subjects.

Reports from the research assistants and observations by the investigators make plain that the machine presentation of the programmed materials was by far the most appealing to the subjects. For precisely how long the novelty of the machine would remain a motivational factor was not determinable but for the length of the present study there appeared little decrease in the power of the machine to both attract and motivate.

Conversely, the presentation by programmed workbook while fruitful according to statistical results did not have the fundamental attractiveness of the machine. Lessons of the same length presented by means of the programmed workbook were regarded by most subjects as somewhat boring. The investigators consider the 75 frame lesson units to be longer than the optimal span of attention and concentration of students at this age and maturity level. Research assistants reported frequent cases of casual treatment of the programmed workbooks with episodes of random marking, cheating by looking ahead, and a generalized lack of motivating property. In this case Skinner's supposition that knowledge of being right is self motivating is, at least at an observational level, not borne out. Substantiated, however, are Holland's comments that machine or devicive presentation which precludes cheating, looking ahead, and other such deviations is necessary for control of the subject's behavior even under unstressful learning conditions such as prevailed in this experimental setting.

Unlike previous experimentation using the same presentation techniques with chronologically older and socially more mature mentally retarded subjects, the subjects in this experiment required a longer period of instruction in order to learn to operate the teaching machine or to manipulate the programmed workbooks.

Approximately the same percentage of concomitant handicaps was found among this group as is noted with the general mental retardation population. Factors of immature behavior, speech handicaps, audiological, orthopedic, and other such difficulties were frequent.

All teachers surveyed felt that both programmed techniques had a marked effect upon the experimental subject's interest in reading. Children not involved in the experimentation frequently requested the opportunity to participate and seemed in general to be intrigued by the machine operation. Teachers also reported generalized gains in self confidence of the pupils and in some cases reported improvements in speech patterns.

An artifact of the experimental procedure was the apparent percentage gains of the control group between the post-test and the 30 day follow-up test. Although the percentage of gain during this period shows as 242 per cent, the actual number of new words acquired by the control group was six words during this period of time. The experimental groups do not show such a large percentage of increase because far greater gains were achieved in the first month of the project.

The experience gained in this pilot project suggests that the following modifications should be incorporated into future work with this material:

1. The format of the workbooks should be changed so that one or two frames appear on each page as the four-frame page was difficult for young children to manipulate.

2. The answer verification portion of the frames could be modified by use of a star to signify the correct choice rather than an actual duplication of the correct answer appearing in the lower portion of the frame.

3. It is recommended that a portion of the frames be simplified to present two choices instead of three choices.

4. It is recommended that the sequence of frames be divided into smaller units of approximately 40 frames instead of 75 frames to allow for more flexibility in altering the presentation sequence in line with individual differences among subjects.

There is little doubt that motivation was increased and learning was accelerated by the experimental procedure. The machines were unquestionably feasible with this chronological and mental age group as were the workbooks, although the machines appear to have some edge as motivators. It seems justifiable, therefore, to recommend that further experimental procedures be undertaken to determine if this learning acceleration is continual and to determine at what point the motivational factors of this type of approach begin to deteriorate with this age level child.

CONCLUSIONS, IMPLICATIONS AND SUMMARY

The purpose of this pilot study was to evaluate the effectiveness of programmed reading materials with culturally deprived slow learners enrolled in the public school system between the ages of 6 and 9 years. The materials used in this study have been extensively evaluated with educable mentally retarded subjects between the ages of 10 and 16 years of age in two previous studies sponsored by United States Office of Education grants (CRP 1267 and OE 7-19-0315-291).

The objective of this study was to evaluate a portion of these programmed materials with a small sample of slow learners between the ages of 6 and 9 years of age to investigate modifications of the materials and techniques which might be needed with this younger age population.

The educational materials used in this study consisted of 2400 programmed frames in which 93 words, phrases and sentences were presented under two treatment conditions to two experimental groups of 15 subjects each. The two experimental conditions were (1) teaching machine presentation and (2) programmed workbooks.

The results of this study indicated that the experimental groups more than doubled their word recognition scores in 13 hours of programmed instruction and learned approximately seven times as many new words as the control group which received only classroom instruction. The machine group showed 100 per cent retention and the workbook group showed 90 per cent retention of the words learned thirty days after completing the programmed sequence.

Students receiving programmed instruction via machine gained 30.7 new words (166% gain) during the instructional period and students using the workbook method gained 33.1 new words (191% gain) over the instructional period as compared with a gain of 4.5 new words (24% gain) for the control group. Calculation of "t" ratios showed the experimental group gains to be significantly greater than those of the control group.

Gains on the Gates Paragraph Reading Test and a paragraph reading test constructed of the programmed words were also high for the experimental group as compared with the control group.

Re-testing at a 30 day interval showed 100 per cent retention for the machine group and 90 per cent retention for the workbook group.

While no specific hypotheses were expressed, the results bear out the expectation that both programmed instructional methods are feasible with this population and this instructional media tends to increase

both motivation and subsequent acquisition of skills basic to reading. Recommended modifications of the instructional materials and presentation techniques appear in the discussion section.

Results of this pilot study lend strong support for further research in this area. More extensive studies utilizing a greater portion of the available programmed materials developed under Grant No. OE 7-19-0315-291 with a much larger experimental population are recommended.

REFERENCES

1. Anderson, I. H. and Dearborn, W. F. Psychology of Teaching Reading. New York: Ronald Press, 1952.

2. Becker, James L. A Programmed Guide to Writing Auto-Instructional Programs. Camden: Radio Corporation of America, 1963.

3. Blackman, Leonard S. and Capobianco, Rudolph J. An evaluation of programmed instruction with the mentally retarded utilizing teaching machines. Amer. J. Ment. Def., Sept., 1965.

4. Cruickshank, W. and Johnson, G. O. Education of Exceptional Children and Youth. Englewood Cliffs, N.J.: Prentice-Hall, 1958.

5. Deutsch, Martin. Social and psychological prospectives on the development of the disadvantaged learner. Merrill, Palmer Quarterly, Spring, 1964.

6. Dunn, Lloyd M. The Peabody Picture Vocabulary Test. American Guidance Service, Inc., 1959.

7. Gates, Arthur I. Gates Primary Reading Test, Type PPR, Paragraph Reading. New York: Bureau of Publications, Teachers College, Columbia University, 1958.

8. Holland, J. G. Teaching machines: an application of principles from the laboratory. J. Exp. Anal. Behav., 3, 1960, pp. 275-287.

9. Kennedy, Wallace A., Van De Reit, Vernon and White, James C., Jr. A Normative Sample of Intelligence and Achievement of Negro Elementary School Children in the Southeastern United States. Monographs of the Society for Research in Child Development, Serial No. 90, 1963, Vol. 28, No. 6, 112 pp.

10. Kirk, Samuel A. Teaching Reading to Slow-Learning Children. New York: Houghton Mifflin Co., 1940.

11. Kirk, Samuel A. Educating Exceptional Children. Boston: Houghton Mifflin Co., 1962.

12. Lumsdaine, A. A. and Glaser, Robert. Teaching Machines and Programmed Learning. Washington: National Education Assn. of the U. S., 1960.

13. Malpass, Leslie F., Gilmore, A. S., Hardy, M.W., and Williams, C.F. Comparison of Two Automated Teaching Procedures for Retarded Children. Tampa: University of South Florida, 1963.

14. Malpass, Leslie F., Hardy, M. W., Gilmore, A. S., and Williams, C. F. Automated instruction for retarded children. Amer. J. Ment. Def., 69, 3, Nov. 1964.

15. Malpass, Leslie F., Gilmore, A. S. and Williams, C. F. Further development, comparison and evaluation of programed instruction for retarded children. U. S. Office of Education Grant OE 7-19-0315-291, in progress. Tampa: University of South Florida.

16. Monroe, M. Children Who Cannot Read. Chicago: Univ. of Chicago Press, 1932.

17. Moore, Omar K. Orthographic symbols and the preschool child--a new approach. Paper presented at Third Minnesota Conference on Gifted Children, University of Minnesota, October 1960.

18. Smith, Edgar A. and Quackenbush, Jack. Devereux teaching aids employed in presenting elementary mathematics in a special education setting. Psychological Reports, 7, 1960, 333-336.

19. Stolurow, Lawrence M. Teaching by Machine. U. S. Department of Health, Education, and Welfare, Office of Education, OE-34010, Cooperative Research Monograph No. 6, U. S. Government Printing Office, Washington, D. C.

20. Thorndike, E. L. Improving the ability to read, Teachers College Record, 36, Oct., Nov., & Dec., 1934.

21. Vernon, M.D. Backwardness in Reading. Cambridge University Press, 1958.

22. Wyckoff, Benjamin. The Wyckoff Film Tutor - Operation Instructions, Model WK-3. Teaching Machines, Inc., 221 San Pedro, N.E., Albuquerque, N. Mex., 1960.

TABLE A

WORDS PROGRAMMED IN 16 UNITS PRESENTED

box	policeman	has	table	need
woman	and	have	telephone	pencil
dog	see	they	bus	ball
girl	sit	yes	get	do
a	walk	no	off	soap
book	run	pull	cat	
house	stop	jump	say	
chair	go	water	here	
school	on	not	come	
the	write	glass	bank	
is	with	of	door	
fire	can	milk	put	
car	can't	mother	work	
street	look	father	child	
man	he	out	up	
this	she	fish	play	
that	it	what	down	
I	money	you	bath	
boy	we	hot	bathroom	
baby	men	cold	take	
television	are	drink	letter	
am	in	eat	mailbox	

TABLE B

MATCHING VARIABLES BY INDIVIDUAL SUBJECTS

MACHINE GROUP

Subject	Sex	Age*	Mental Age**	Programmed Words Known	Gates Paragraph Reading R. S.	Gates Paragraph Reading Gr. Pl.
1	F	7-11	5.6	8	0	1.3
2	F	9-9	7.0	10	1	1.4
3	M	10-2	7.8	12	8	1.9
4	M	7-2	6.4	24	3	1.5
5	M	8-1	7.5	34	3	1.5
6	M	7-7	6.9	8	0	1.45
7	F	6-11	4.9	18	3	1.5
8	F	7-3	6.4	10	1	1.4
9	M	7-3	6.8	29	4	1.55
10	F	7-5	7.5	7	1	1.4
11	F	7-9	8.1	15	0	1.3
12	F	8-2	6.5	37	0	1.3
13	F	7-11	6.7	12	5	1.6
14	F	7-9	6.0	28	3	1.5
15	M	7-6	6.5	23	2	1.45

*Expressed as years and months
**Expressed as fractional parts of a year

TABLE B

MATCHING VARIABLES BY INDIVIDUAL SUBJECTS

WORKBOOK GROUP

Subject	Sex	Age*	Mental Age**	Programmed Words Known	Gates Paragraph Reading R. S.	Gates Paragraph Reading Gr. Pl.
1	F	7-9	5.8	32	8	1.9
2	M	7-1	4.7	19	1	1.4
3	F	7-8	7.2	0	1	1.4
4	M	8-9	8.1	17	7	1.7
5	M	8-1	8.0	16	6	1.65
6	M	6-9	5.0	20	0	1.3
7	F	7-1	6.0	9	2	1.45
8	M	6-11	6.4	24	3	1.5
9	M	7-1	6.5	29	5	1.6
10	M	7-3	6.5	10	5	1.6
11	F	7-6	7.1	7	7	1.7
12	M	6-10	5.9	26	4	1.55
13	F	7-3	6.5	12	3	1.5
14	M	7-2	6.3	27	4	1.55
15	M	7-5	6.6	12	7	1.7

*Expressed as years and months
**Expressed as fractional parts of a year

TABLE B

MATCHING VARIABLES BY INDIVIDUAL SUBJECTS

CONTROL GROUP

Subject	Sex	Age*	Mental Age**	Programmed Words Known	Gates Paragraph Reading R. S.	Gates Paragraph Reading Gr. Pl.
1	M	7-4	6.1	4	4	1.55
2	M	7-8	7.0	8	1	1.4
3	M	6-11	5.9	28	2	1.45
4	M	6-11	6.2	24	3	1.5
5	M	6-11	5.3	46	0	1.3
6	M	7-7	5.4	0	0	1.3
7	F	7-3	5.7	12	3	1.5
8	F	7-3	6.4	33	11	2.2
9	F	7-0	5.3	29	3	1.5
10	M	7-10	7.3	22	4	1.55
11	F	8-8	7.0	16	9	2.1
12	M	7-7	6.1	36	3	1.5
13	F	7-3	6.5	8	4	1.55
14	F	6-11	5.5	13	7	1.7
15	M	6-11	5.7	2	1	1.4

*Expressed as years and months
**Expressed as fractional parts of a year

TABLE C

SIMPLE ANALYSIS OF VARIANCE

MENTAL AGE - ALL GROUPS

Source	df	SS	MS	F
Between Gps.	2	18.5	.425	.49*
Within Gps.	42	36.25	.86	
Total	44	54.75	1.285	

PROGRAMMED WORDS KNOWN - PRE TEST ALL GROUPS

Between Gps.	2	15.45	7.725	.0619*
Within Gps.	42	5235.05	124.644	
Total	44	5250.50	132.369	

* Not significant at .01 or .05 level

TABLE D

SPECIMEN COPY OF PARAGRAPH READING TEST*

I see a woman and a girl.
The car is in the street.
The chair and the book are in the house.
This boy can go to this school.
That policeman can stop cars.
A baby can't run.
We have a pencil.
The dog is in the box.

He can write with it.
She has a ball.
I can sit and walk.
They have the television on.
Look. I am a man.
The men are running to see the fire.
It is money.

Do you sit on the table to eat?
I can drink a glass of cold milk.
A cat can eat fish.
What do I need to take?
I get off the bus at school.
Pull the telephone off the table.
Put the money in the bank.
Come here. Jump down in the water.

Do mother and father work?
I do not play in the bathroom.
What do I say? Yes? No?
Put the letter up.
The mailbox has a door in it.
The girl is a child.
I am walking out of the bus.

*All words used in the above Paragraph Reading Test are from the list of 93 programmed words taught.

TABLE E

PROGRAMMED WORD GAIN

MACHINE GROUP

Subjects	Programmed Words Known Pre	Programmed Words Known Post	Programmed Words Gain
1	8	49	41
2	10	41	31
3	12	39	27
4	24	74	50
5	34	56	22
6	8	16	8
7	18	44	26
8	10	37	27
9	29	53	24
10	7	22	15
11	15	65	50
12	37	77	40
13	12	41	29
14	28	62	34
15	23	60	37

TABLE E

PROGRAMMED WORD GAIN

WORKBOOK GROUP

Subjects	Programmed Words Known Pre	Programmed Words Known Post	Programmed Words Gain
1	32	76	44
2	19	29	10
3	0	13	13
4	17	72	55
5	16	56	40
6	20	54	34
7	9	28	19
8	24	47	23
9	29	63	34
10	10	47	37
11	7	56	49
12	26	54	28
13	12	51	39
14	27	65	38
15	12	45	33

TABLE E

PROGRAMMED WORD GAIN

CONTROL GROUP

Subject	Programmed Words Known Pre	Programmed Words Known Post	Programmed Words Gain
1	4	14	10
2	8	13	5
3	28	36	8
4	24	34	10
5	46	53	7
6	0	4	4
7	12	18	6
8	33	36	3
9	29	33	4
10	22	25	3
11	16	16	0
12	36	42	6
13	8	7	-1
14	13	13	0
15	2	4	2

TABLE F

GATES PARAGRAPH READING TEST GAIN

MACHINE GROUP

Subject	Raw Score Pre	Grade Placement Pre	Raw Score Post	Grade Placement Post	Raw Score Gain	Grade Placement Gain
1	0	1.30	2	1.45	2	.15
2	1	1.40	4	1.55	3	.15
3	8	1.90	5	1.60	-3	-.30
4	3	1.50	6	1.65	3	.15
5	3	1.50	7	1.70	4	.20
6	0	1.45	4	1.55	4	.10
7	3	1.50	5	1.60	2	.10
8	1	1.40	4	1.55	3	.15
9	4	1.55	7	1.70	3	.15
10	1	1.40	8	1.90	7	.50
11	0	1.30	7	1.70	7	.40
12	0	1.30	1	1.40	1	.10
13	5	1.60	10	2.15	5	.55
14	3	1.50	8	1.90	5	.40
15	2	1.45	4	1.55	2	.10

TABLE F

GATES PARAGRAPH READING TEST GAIN

WORKBOOK GROUP

Subject	Raw Score Pre	Grade Placement Pre	Raw Score Post	Grade Placement Post	Raw Score Gain	Grade Placement Gain
1	8	1.90	8	1.90	0	0
2	1	1.40	5	1.60	4	.20
3	1	1.40	3	1.50	2	.10
4	7	1.70	10	2.15	3	.45
5	6	1.65	10	2.15	4	.50
6	0	1.30	7	1.70	7	.40
7	2	1.45	3	1.50	1	.05
8	3	1.50	3	1.50	0	0
9	5	1.60	7	1.70	2	.10
10	5	1.60	5	1.60	0	0
11	7	1.70	8	1.90	1	.20
12	4	1.55	6	1.65	2	.10
13	3	1.50	7	1.70	4	.20
14	4	1.55	6	1.65	2	.10
15	7	1.70	6	1.65	-1	-.05

TABLE F

GATES PARAGRAPH READING TEST GAIN

CONTROL GROUP

Subject	Raw Score Pre	Grade Placement Pre	Raw Score Post	Grade Placement Post	Raw Score Gain	Grade Placement Gain
1	4	1.55	4	1.55	0	0
2	1	1.40	7	1.70	6	.30
3	2	1.45	9	2.10	7	.65
4	3	1.50	6	1.65	3	.15
5	0	1.30	6	1.65	6	.35
6	0	1.30	2	1.45	2	.15
7	3	1.50	2	1.45	-1	-.05
8	11	2.20	11	2.20	0	0
9	3	1.50	6	1.65	3	.15
10	4	1.55	4	1.55	0	0
11	9	2.10	5	1.60	-4	-1.50
12	3	1.50	7	1.70	4	.20
13	4	1.55	1	1.40	-3	-.15
14	7	1.70	4	1.55	-3	-.15
15	1	1.40	2	1.45	1	.05

TABLE G

PARAGRAPH READING TEST WORD GAIN

MACHINE GROUP

Subject	Pre-Test	Post-Test	Pre to Post-Test Gain
1	57	145	88
2	27	119	92
3	8	134	126
4	44	97	53
5	20	164	144
6	36	116	95
7	95	119	24
8	16	42	26
9	42	122	80
10	24	64	40
11	23	127	104
12	15	67	52
13	28	141	113
14	128	169	41
15	87	152	65

TABLE G

PARAGRAPH READING TEST WORD GAIN

WORKBOOK GROUP

Subject	Pre-Test	Post-Test	Pre to Post-Test Gain
1	0	20	20
2	17	92	75
3	15	160	145
4	107	164	57
5	22	135	113
6	14	127	113
7	16	73	57
8	67	126	59
9	30	149	119
10	8	71	63
11	33	136	103
12	25	101	76
13	89	160	71
14	64	125	61
15	42	102	60

TABLE G

PARAGRAPH READING TEST WORD GAIN

CONTROL GROUP

Subject	Pre-Test	Post-Test	Pre to Post-Test Gain
1	7	65	58
2	99	118	19
3	27	46	19
4	63	82	19
5	37	100	63
6	79	107	28
7	27	51	23
8	126	145	19
9	83	106	23
10	28	56	28
11	80	102	64
12	12	31	19
13	11	41	30
14	0	8	8
15	0	3	3

TABLE H

t RATIOS BETWEEN TREATMENT GROUP MEANS

	Workbook	Control
Word Gain - Pre Test to Post Test		
Machine	.58	9.16
Workbook		8.79
Word Gain - Pre Test to 30 Day Post Test		
Machine	.41	6.06
Workbook		8.79